

**ANNUAL RESEARCH REPORT**  
**FY 2008**  
**March 2009**

**1.     Title:**

Demographic Characteristics and Ecology of Spotted Owls (*Strix occidentalis caurina*) in the Southern Oregon Cascades.

**2.     Principal Investigators and Organizations:**

Dr. Robert Anthony (PI) (Demography-RWU 4203); Biologists: S. Andrews, L. Friar, T. Phillips, D. Strejc and F. Wagner, Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon.

**3.     Study Objectives:**

- a. Estimate the population parameters of northern spotted owls on the Rogue River-Siskiyou and Fremont-Winema National Forests, specifically fecundity, survival rates, and annual rates of population change.
- b. Examine the ecology of spotted owls including diet, nesting habitat, and interspecific interactions.
- c. Communicate results to other researchers examining spotted owl ecology throughout the Pacific Northwest.

**4.     Potential Benefit or Utility of the Study:**

Studying the population biology, foraging ecology, and prey ecology of spotted owls will increase our understanding of factors affecting spotted owl populations. This study offers insights into how conservation can enhance or maintain habitat while concurrently addressing the validation and effectiveness monitoring requirements of the Northwest Forest Plan (1994). The Southern Oregon Cascades Study Area is one of five study areas in Oregon that are part of the Effectiveness Monitoring Program for Spotted Owls in the Northwest Forest Plan (Lint et al. 1999).

**5.     Study Description and Survey Design:**

The design of this project follows the framework of a demographic study, a collection of known owl sites within a bounded area. This study gathered information on adult and subadult owl survival rates, reproductive rates, annual rate of population change, and other population characteristics (Anthony et al. 2006). The study utilized a sample of northern spotted owls within Late-Successional Reserve (LSR) or Matrix Land-use Allocations (LUA)(USDA and USDI 1994) and Congressionally Reserved Wilderness Areas (CRWA).

## **6. Study Area Description and Historical Background**

The Southern Cascades Study Area incorporates approximately 2,230 km<sup>2</sup> of federally managed forest land. The area is geographically situated on lands administered by the Rogue River-Siskiyou National Forest (High Cascades Ranger District) and the Fremont-Winema National Forest (Klamath Ranger District) (Figure 1). The study area occupies the southern terminus of the Oregon Cascades including portions of both the western and eastern provinces. Landforms are primarily volcanic in origin and consist of plateaus and moderately dissected terrain (USDA and USDI 1994). The study area lies within the Mixed-Conifer, *Abies concolor*, *Abies magnifica* var. *shastensis*, and *Tsuga mertensiana* zones at elevations ranging from 900-2000 meters (Franklin and Dyrness 1973).

Many of the spotted owl sites within the study area were initially identified during surveys conducted by the USDA-Forest Service (USFS) and Oregon Dept. of Fish and Wildlife (ODFW) to meet agency regulations for management activities. Beginning in the 1970's, surveys by agency personnel were conducted at proposed Timber Sales, Project Areas, Random Sampling Areas and Spotted Owl Management Areas (SOMA). In later years, surveys included Spotted Owl Habitat Areas (SOHA) and Habitat Conservation Areas (HCA). USFS personnel (with assistance from USDI-Bureau of Land Management (BLM)) began banding spotted owls as early as 1987 on the Rogue River-Siskiyou National Forest and 1990 on the Fremont-Winema National Forest. Personnel from the Oregon Cooperative Fish and Wildlife Research Unit (OCFWRU) began assisting with surveys and banding on USFS lands in 1990. In 1991 most USFS lands were incorporated into the Siskiyou and Cascade Mountains Spotted Owl Study Area, a large demographic study encompassing mixed ownership lands in southwestern Oregon. From 1992 to 1996 part of the Klamath Ranger District west of Klamath Falls was visited as a part of the Surveyor Mountain Spotted Owl Density Study Area by the Lakeview District BLM.. U.S. Forest Service monitoring efforts were largely discontinued on the Rogue River-Siskiyou National Forest by 1993, and OCFWRU personnel assumed most of these responsibilities. The OCFWRU worked on the Fremont-Winema National Forest as a part of the Siskiyou and Cascades Mountains Study Area in support of USFS personnel and private contractors until 1996.

The Southern Cascades Spotted Owl Study Area was established in 1997 as one of the eight long-term monitoring sites in the Effectiveness Monitoring Program for Spotted Owls for the Northwest Forest Plan (Lint et al. 1999). The study area incorporated portions of the Siskiyou and Cascade Mountains Study Area and the Surveyor Mountain Density Study Area. There are 88 sites within the boundaries of the current study that have been surveyed continuously from 1992 to 2008. Since the 1998 field season, additional historic owl locations and previously undocumented sites within the boundaries of the study have been incorporated into the sample totaling 169 sites surveyed in 2008.

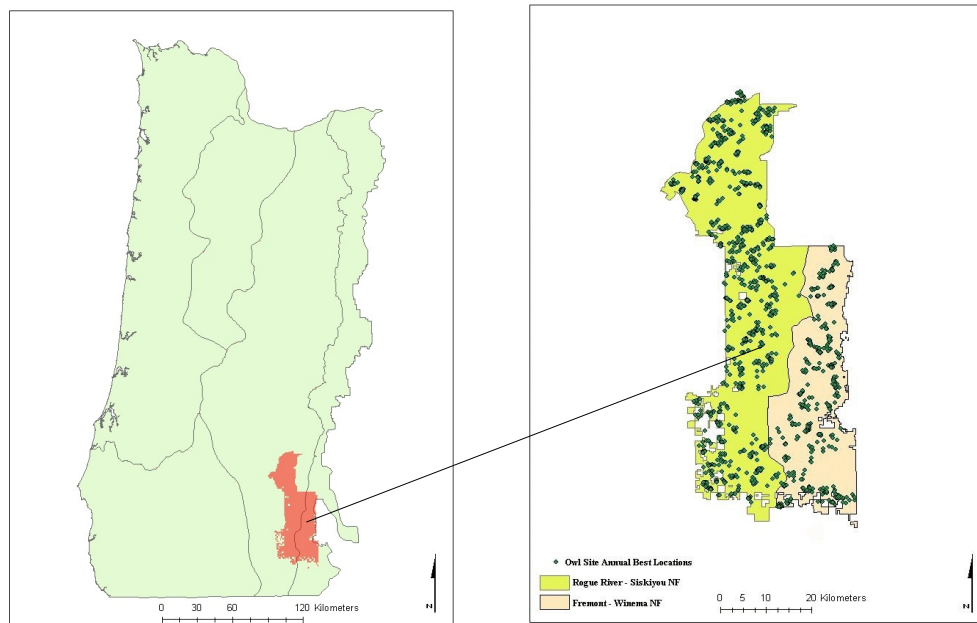


Figure 1. The Southern Cascades Study Area and historic annual spotted owl locations, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008.

An important component of the Southern Cascades Northern Spotted Owl Study Area is the Late-successional Reserves: Rogue-Umpqua Divide (LSR 225), Middle Fork (LSR 226), Dead Indian (LSR 227), Clover Creek (LSR 228), and Sevenmile Creek (LSR 229). Of these, Rogue-Umpqua Divide, Middle Fork, and Dead Indian are large encompassing 16,050, 20,080, and 41,310 ha., respectively (USDA 1998). Clover Creek and Sevenmile Creek LSRs are smaller, incorporating 1,130 and 3,710 ha. (USDA 1997). The LSRs are situated entirely within the study area. Dead Indian LSR spans the crest of the southern Oregon Cascades, and is jointly administered by the Rogue River-Siskiyou and Fremont-Winema National Forests. Three Congressionally Reserved Wilderness Areas are also located within the study area. Owl sites are situated on the Sky Lakes (45,800 ha.), Mountain Lakes (9,300 ha.) and a portion of the Rogue-Umpqua Divide Wilderness (2,064 ha.)(Figure 2).

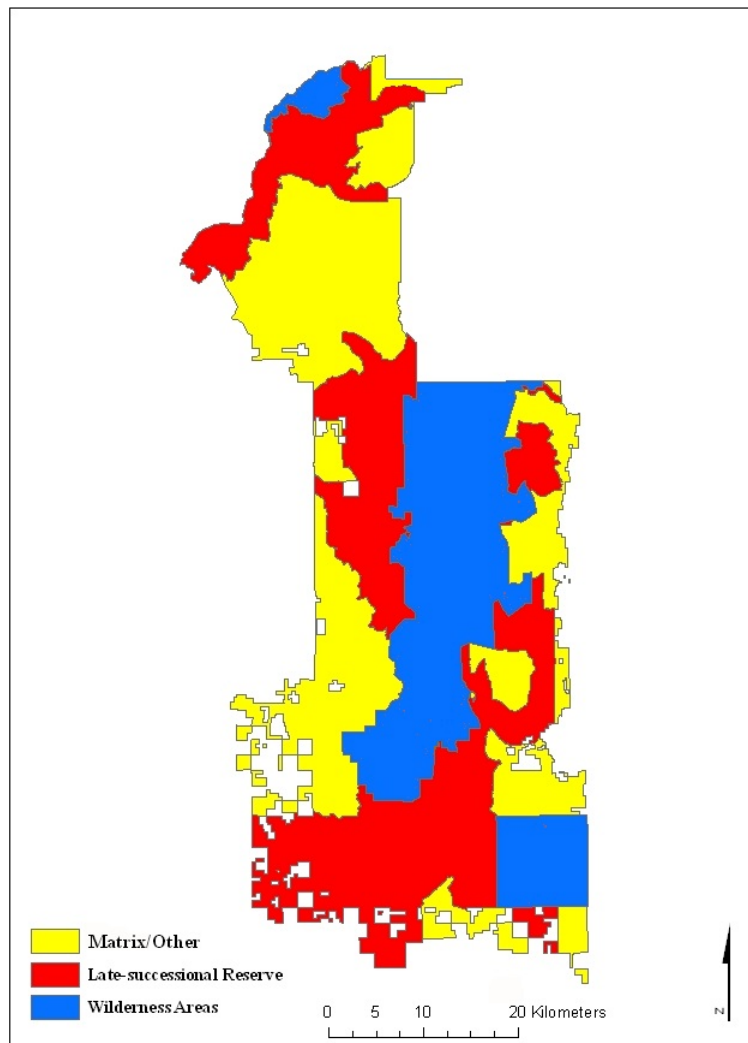


Figure 2. Land-use Allocations and owl sites within the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008.

## 7. Research Accomplishments:

### Site Occupancy

Spotted owls occupied 48% of the 169 sites we visited in 2008. Among the sites that were surveyed, 47 were occupied by pairs, a large decline from 2007 (Figure 3). At 8 and 26 sites, respectively, single owls or owls whose social status was not determined were detected which was a large increase from previous years (Table 1). The percentage of sites surveyed to protocol that were occupied by spotted owls decreased substantially in 2008 (47.9%) compared to all preceding years ( $\bar{x} = 73.7\%$ ,  $SE = 3.24$ ,  $n = 19$ ). Among the 88 sites with continuous survey effort between 1992 and 2008, 51% were occupied by spotted owls reflecting a continuing decline over the years of the study ( $\bar{x} = 75.5\%$ ,  $SE = 2.85$ ,  $n = 17$ )(Figure 4).

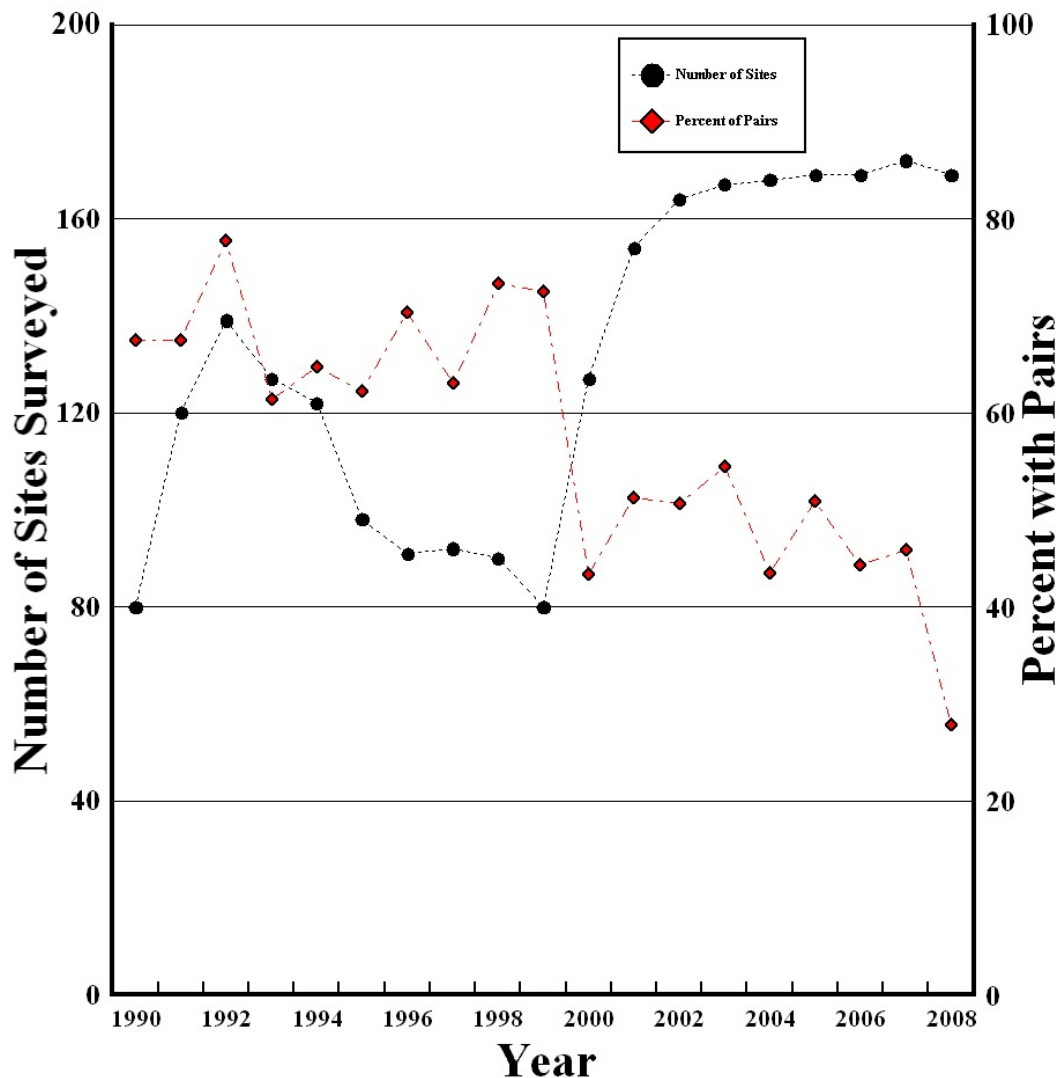


Figure 3. Annual number of sites surveyed to protocol and the percentage of sites with owl pairs on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008.

Table 1. Number of northern spotted owl sites surveyed and their respective occupancies on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008<sup>a</sup>.

| Year | # Sites Surveyed <sup>a</sup> | # Sites w/ Pairs <sup>a</sup> | # Sites w/ Single Owls <sup>a</sup> | # Sites w/ Social Status Unknown <sup>b</sup> | Total Occupied Sites | # of Sites Unoccupied <sup>c</sup> | % Sites Occupied |
|------|-------------------------------|-------------------------------|-------------------------------------|---|----------------------|------------------------------------|------------------|
| 1990 | 80                            | 54                            | 7                                   | 12  | 73                   | 7                                  | 91               |
| 1991 | 120                           | 81                            | 5                                   | 21  | 107                  | 13                                 | 89               |
| 1992 | 139                           | 108                           | 3                                   | 15  | 126                  | 13                                 | 91               |
| 1993 | 127                           | 78                            | 7                                   | 24  | 109                  | 18                                 | 86               |
| 1994 | 122                           | 79                            | 5                                   | 14  | 98                   | 24                                 | 80               |
| 1995 | 98                            | 61                            | 8                                   | 15  | 84                   | 14                                 | 86               |
| 1996 | 91                            | 64                            | 3                                   | 9   | 76                   | 15                                 | 84               |
| 1997 | 92                            | 58                            | 3                                   | 12  | 73                   | 19                                 | 79               |
| 1998 | 90                            | 66                            | 2                                   | 8   | 76                   | 14                                 | 84               |
| 1999 | 80                            | 58                            | 6                                   | 6   | 70                   | 10                                 | 88               |
| 2000 | 127                           | 55                            | 10                                  | 15  | 80                   | 47                                 | 63               |
| 2001 | 154                           | 79                            | 1                                   | 18  | 98                   | 56                                 | 64               |
| 2002 | 164                           | 83                            | 9                                   | 19  | 111                  | 53                                 | 68               |
| 2003 | 167                           | 91                            | 5                                   | 15  | 111                  | 56                                 | 67               |
| 2004 | 168                           | 73                            | 0                                   | 19  | 92                   | 76                                 | 55               |
| 2005 | 169                           | 86                            | 7                                   | 17  | 110                  | 59                                 | 65               |
| 2006 | 169                           | 75                            | 7                                   | 17  | 99                   | 70                                 | 59               |
| 2007 | 172                           | 79                            | 3                                   | 12  | 94                   | 78                                 | 55               |
| 2008 | 169 <sup>d</sup>              | 47                            | 8                                   | 26  | 81                   | 88                                 | 48               |

<sup>a</sup> All sites which were surveyed to protocol; status as determined by protocol (Forsman 1995).

<sup>b</sup> Sites with a response by a male and/or female that did not meet pair or single status with  $\geq 3$  night visits.

<sup>c</sup> A minimum of 3 nighttime visits without a response was needed to infer unoccupied status.

<sup>d</sup> At five sites the final night visit was conducted between September 1-4, 2009 and the sites were determined to be unoccupied under the survey protocol guidelines of the Northwest Forest Plan Effectiveness Monitoring Program for northern spotted owls (Lint et al. 1999).

Spotted owls occupied 7 Wilderness, 47 LSR, and 27 Matrix sites in 2008 (Table 2). The percentage of occupied sites in Wilderness decreased from 50% in 2007 to 44% in 2008 while the percentage of sites occupied by pairs decreased substantially (50 vs. 31%). The percentage of occupied sites in the LSRs decreased between 2007 and 2008 (57 vs. 47%), and the percentage of sites occupied by owl pairs decreased sharply (47 vs. 27%). In the Matrix allocation the percentage of occupied sites decreased slightly in 2008 (51%) compared to 2007 (52%), and the percentage of sites occupied by owl pairs also decreased dramatically (43 vs. 28%). The percentage of occupied sites with owl pairs in each Land-use type decreased substantially from 2007 to 2008; CWRA (100 vs. 71%), matrix (82 vs. 56%), and LSR (83 vs. 57%)(Figure 5).

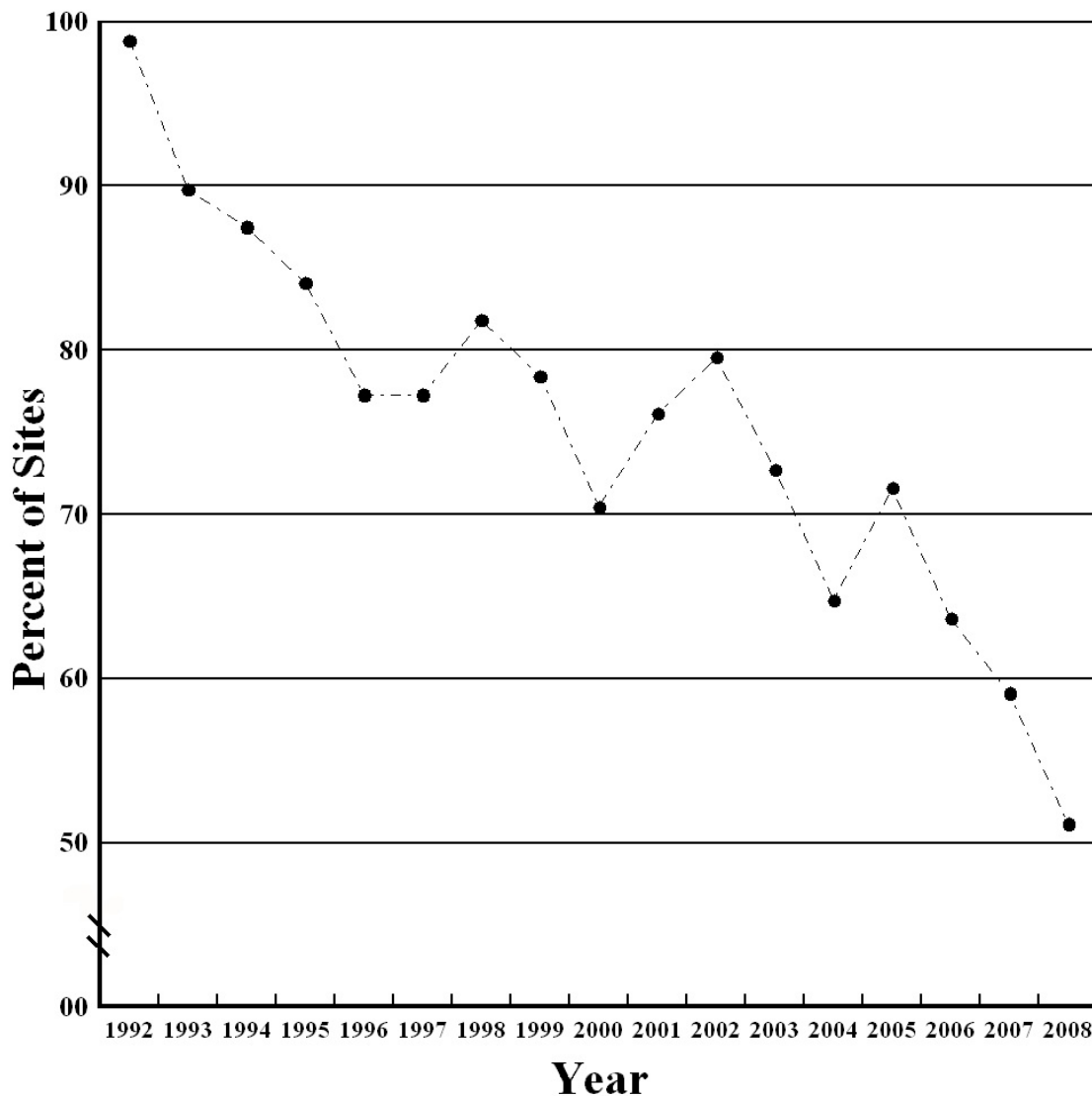


Figure 4. Annual percentage of sites surveyed that were occupied by spotted owls for 88 areas with continuous survey effort on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1992-2008.

The number of spotted owl pairs located in 2008 at the five LSRs decreased sharply compared to previous years. There were 12 owl pairs located in the Rogue-Umpqua Divide LSR ( $\bar{x}$  = 11.8, SE = 0.73; n = 12; min. = 7, max. = 15). There were only 6 pairs located in the Middle Fork LSR, the lowest number observed during the study and a >50% decline from 2007 ( $\bar{x}$  = 12.7, SE = 0.78, n = 12; min. = 6, max. = 16). In the Dead Indian LSR, 7 pairs were found in 2008, an approximately 60% decline from 2007 and a record low during the study period ( $\bar{x}$  = 14.7, SE = 1.18, n = 12; min. = 7, max. = 20). There were 2 pairs in the Sevenmile Creek LSR in 2008, the same as in 2007 ( $\bar{x}$  = 3.08, SE = 0.23, n = 12; min. = 2, max. = 4). There were no owl pairs

located in the Clover Creek LSR during the 2008 breeding season ( $\bar{x} = 0.82$ ,  $SE = 0.18$ ,  $n = 11$ ; min. = 0, max. = 2).

Table 2. Number of spotted owl sites surveyed to protocol and their respective occupancies, by Land-use Allocation, on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1997-2008<sup>a</sup>.

| Land-Use Allocation <sup>b</sup> | Year | # Sites Surveyed | # Sites w/ Pairs | # Sites w/ Single Owls | # Sites w/ Social Status Unknown | Total Occupied Sites | # Sites Unoccupied | % Sites Occupied |
|----------------------------------|------|------------------|------------------|------------------------|----------------------------------|----------------------|--------------------|------------------|
| Matrix                           |      |                  |                  |                        |                                  |                      |                    |                  |
|                                  | 1997 | 20               | 0                | 4                      | 4                                | 28                   | 4                  | 86               |
|                                  | 1998 | 24               | 18               | 0                      | 1                                | 19                   | 5                  | 79               |
|                                  | 1999 | 20               | 17               | 0                      | 2                                | 19                   | 1                  | 95               |
|                                  | 2000 | 38               | 17               | 1                      | 5                                | 23                   | 15                 | 61               |
|                                  | 2001 | 48               | 22               | 1                      | 5                                | 28                   | 20                 | 58               |
|                                  | 2002 | 51               | 24               | 3                      | 8                                | 36                   | 16                 | 69               |
|                                  | 2003 | 53               | 28               | 0                      | 6                                | 34                   | 19                 | 64               |
|                                  | 2004 | 54               | 22               | 0                      | 8                                | 30                   | 24                 | 56               |
|                                  | 2005 | 54               | 28               | 1                      | 5                                | 34                   | 20                 | 63               |
|                                  | 2006 | 54               | 23               | 0                      | 4                                | 27                   | 27                 | 50               |
|                                  | 2007 | 54               | 23               | 3                      | 2                                | 28                   | 26                 | 52               |
|                                  | 2008 | 53               | 15               | 4                      | 8                                | 27                   | 26                 | 51               |
| LSR                              |      |                  |                  |                        |                                  |                      |                    |                  |
|                                  | 1997 | 56               | 35               | 3                      | 7                                | 45                   | 11                 | 80               |
|                                  | 1998 | 59               | 41               | 2                      | 7                                | 50                   | 9                  | 84               |
|                                  | 1999 | 53               | 37               | 6                      | 3                                | 46                   | 8                  | 87               |
|                                  | 2000 | 82               | 33               | 9                      | 9                                | 49                   | 31                 | 62               |
|                                  | 2001 | 91               | 50               | 0                      | 12                               | 62                   | 29                 | 74               |
|                                  | 2002 | 98               | 52               | 5                      | 11                               | 68                   | 30                 | 69               |
|                                  | 2003 | 98               | 53               | 4                      | 7                                | 64                   | 34                 | 65               |
|                                  | 2004 | 98               | 43               | 0                      | 10                               | 53                   | 45                 | 54               |
|                                  | 2005 | 99               | 52               | 4                      | 9                                | 65                   | 34                 | 66               |
|                                  | 2006 | 99               | 45               | 7                      | 12                               | 64                   | 35                 | 65               |
|                                  | 2007 | 102              | 48               | 0                      | 10                               | 58                   | 44                 | 57               |
|                                  | 2008 | 100              | 27               | 3                      | 17                               | 47                   | 53                 | 47               |
| Wilderness                       |      |                  |                  |                        |                                  |                      |                    |                  |
|                                  | 1997 | 7                | 3                | 0                      | 1                                | 4                    | 3                  | 57               |
|                                  | 1998 | 7                | 7                | 0                      | 0                                | 7                    | 0                  | 100              |
|                                  | 1999 | 7                | 4                | 0                      | 1                                | 5                    | 2                  | 71               |
| cont.                            |      |                  |                  |                        |                                  |                      |                    |                  |



| Land-Use Allocation <sup>b</sup> | Year | # Sites Surveyed | # Sites w/ Pairs | # Sites w/ Single Owls | # Sites w/ Social Status Unknown | Total Occupied Sites | # Sites Unoccupied | % Sites Occupied |
|----------------------------------|------|------------------|------------------|------------------------|----------------------------------|----------------------|--------------------|------------------|
| CWRA                             |      |                  |                  |                        |                                  |                      |                    |                  |
|                                  | 2000 | 15               | 7                | 0                      | 1                                | 6                    | 1                  | 86               |
|                                  | 2001 | 15               | 7                | 0                      | 1                                | 8                    | 7                  | 53               |
|                                  | 2002 | 15               | 7                | 1                      | 0                                | 8                    | 7                  | 57               |
|                                  | 2003 | 16               | 10               | 1                      | 2                                | 13                   | 3                  | 81               |
|                                  | 2004 | 16               | 8                | 0                      | 1                                | 9                    | 7                  | 56               |
|                                  | 2005 | 16               | 6                | 2                      | 3                                | 11                   | 5                  | 69               |
|                                  | 2006 | 16               | 7                | 0                      | 2                                | 9                    | 7                  | 56               |
|                                  | 2007 | 16               | 8                | 0                      | 0                                | 8                    | 8                  | 50               |
|                                  | 2008 | 16               | 5                | 1                      | 1                                | 7                    | 9                  | 44               |

<sup>a</sup> See Table 1 for column heading definitions.

<sup>b</sup> See the Northwest Forest Plan (1994) for a description of Matrix and LSR Land-use Allocations.

## Age and Sex Composition

A minimum of 130 non-juvenile owls were detected in 2008. Of the owls which we could assign to a non-juvenile age class, 93.5% were adults ( $\geq 3$  years old) and 6.5% were subadults (Table 3). We could not ascertain the age of 17% of the study population, which was less than that for most years ( $\bar{x} = 19.1\%$ ,  $SE = 3.12$ ,  $n = 19$ ). The majority of unknown aged owls represented auditory detections without visual observation, usually during nighttime surveys (Table 3).

During the course of the study, there have been fluctuations in the number of subadults in the sample (min. = 2; max. = 18) (Table 3). In 2008, 5% of the study sample was composed of subadults which equaled the average representation of subadults for all years combined.

On average 54% of the study area population has been composed of males, and males constituted a majority of the owls detected (54%) in 2008. The proportional representation of males and females has not shown apparent deviations among years.

In aggregate across the years of the study, there is strong evidence of a difference in the number of males and females relative to the representation of adults and subadults (Akaike Weight ( $w_i$ ) = 0.921). There is no support for annual age related differences in the representation of sexes ( $w_i = 0.000$ ), or in 2008 ( $B_0 = -0.179$ ,  $SE = 0.1998$ , 95% CI = -0.5706 to 0.2126) (Burnham and Anderson 2002).

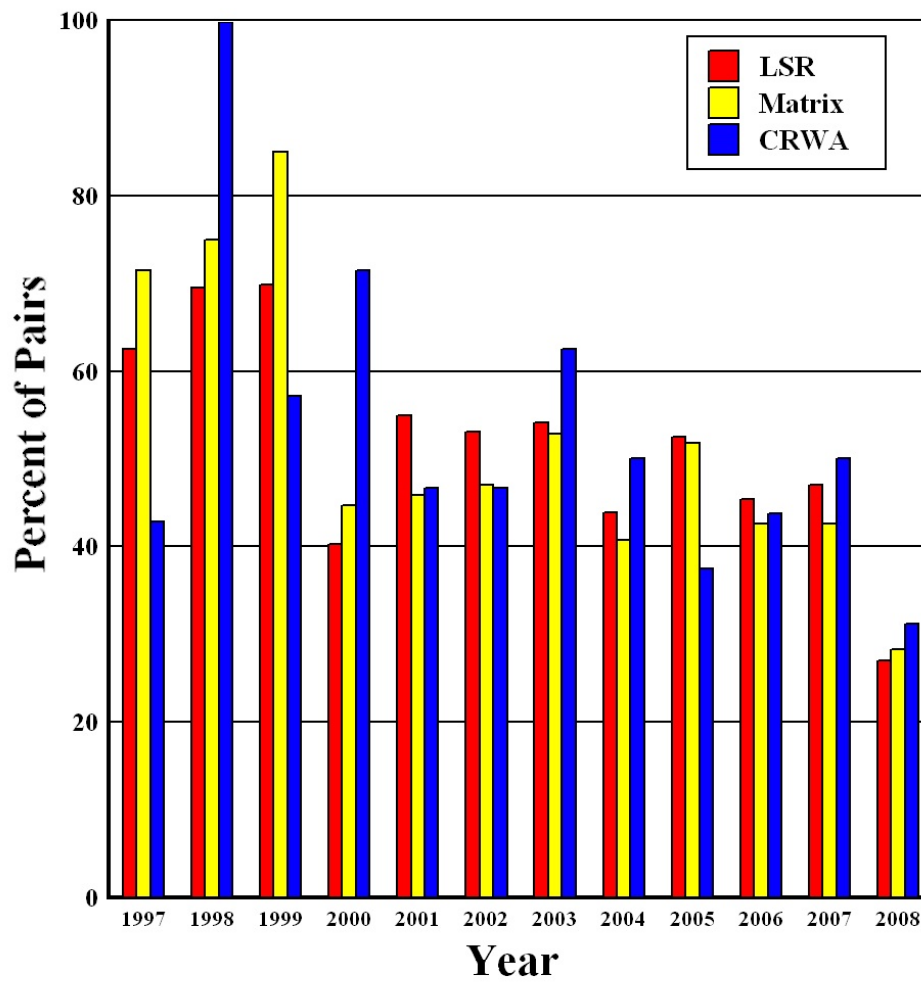


Figure 5. Percentage of sites surveyed to protocol that were occupied by northern spotted owl pairs by Land-use Allocation on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1997-2008.

Table 3. Age and sex composition of northern spotted owls detected on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008<sup>a</sup>.

| Year | Adults<br>(M,F) | Subadults<br>(M,F) | Age Unknown<br>(M,F) | Age Combined<br>(M,F) | Juveniles <sup>b</sup> | Subadults (%) <sup>c</sup> | Males (%) |
|------|-----------------|--------------------|----------------------|-----------------------|------------------------|----------------------------|-----------|
| 1990 | 54<br>(30,24)   | 2<br>(1,1)         | 93<br>(53,40)        | 149<br>(84,65)        | 28                     | 4                          | 56        |
| 1991 | 112<br>(57,55)  | 6<br>(2,4)         | 80<br>(44,36)        | 198<br>(103,95)       | 33                     | 5                          | 52        |
| 1992 | 139<br>(78,61)  | 7<br>(4,3)         | 101<br>(47,54)       | 247<br>(129,118)      | 119                    | 5                          | 52        |
| 1993 | 136<br>(76,60)  | 12<br>(5,7)        | 43<br>(21,22)        | 191<br>(102,89)       | 16                     | 8                          | 53        |
| 1994 | 137<br>(71,66)  | 11<br>(7,4)        | 32<br>(18,14)        | 180<br>(96,84)        | 64                     | 7                          | 53        |
| 1995 | 126<br>(64,62)  | 9<br>(7,2)         | 15<br>(12,3)         | 150<br>(83,67)        | 24                     | 7                          | 55        |
| 1996 | 120<br>(59,61)  | 5<br>(4,1)         | 19<br>(12,7)         | 144<br>(75,69)        | 45                     | 4                          | 52        |
| 1997 | 114<br>(63,51)  | 7<br>(2,5)         | 15<br>(8,7)          | 136<br>(73,63)        | 18                     | 6                          | 54        |
| 1998 | 133<br>(70,63)  | 4<br>(3,1)         | 19<br>(12,7)         | 156<br>(85,71)        | 45                     | 3                          | 55        |
| 1999 | 120<br>(69,51)  | 7<br>(1,6)         | 16<br>(10,6)         | 143<br>(80,63)        | 12                     | 6                          | 56        |
| 2000 | 112<br>(66,46)  | 10<br>(2,8)        | 22<br>(15,7)         | 144<br>(83,61)        | 59                     | 8                          | 58        |
| 2001 | 150<br>(80,70)  | 9<br>(3,6)         | 26<br>(20,6)         | 185<br>(103,82)       | 18                     | 6                          | 56        |
| 2002 | 157<br>(86,71)  | 14<br>(6,8)        | 26<br>(17,9)         | 197<br>(109,88)       | 98                     | 8                          | 55        |
| 2003 | 168<br>(90,78)  | 14<br>(3,11)       | 24<br>(17,7)         | 206<br>(110,96)       | 39                     | 8                          | 53        |
| 2004 | 140<br>(71,69)  | 11<br>(5,6)        | 22<br>(14,8)         | 173<br>(90,83)        | 106                    | 7                          | 52        |
| 2005 | 158<br>(79,79)  | 18<br>(10,8)       | 34<br>(22,12)        | 210<br>(111,99)       | 32                     | 10                         | 53        |
| 2006 | 145<br>(78,67)  | 18<br>(9,9)        | 20<br>(12,8)         | 183<br>(99,84)        | 30                     | 11                         | 54        |
| 2007 | 151<br>(76,75)  | 7<br>(2,5)         | 19<br>(12,7)         | 177<br>(90,87)        | 67                     | 4                          | 51        |
| 2008 | 101<br>(55,46)  | 7<br>(2,5)         | 22<br>(12,10)        | 130<br>(69,61)        | 1                      | 5                          | 53        |

<sup>a</sup>Owls where both age and sex were undetermined are not included in tabulation.

<sup>b</sup>Juvenile owl numbers represent the yearly total number of all young located.

<sup>c</sup>Known age owls only included in calculations

## Nest Success

We checked 32 owl pairs for nesting success in 2008. One pair attempted to nest and this was the fewest nesting attempts documented during the study. On average, 54% (SE = 5.70; min. = 3%; max = 86%) of pairs in the population have attempted to nest in each of the last 19 years. Prior to 2006 there had been a tendency for high and low reproduction on alternate years, the relatively high productivity observed in 2007 followed by the very low productivity in 2008 may indicate a resumption of that pattern (Figure 6).

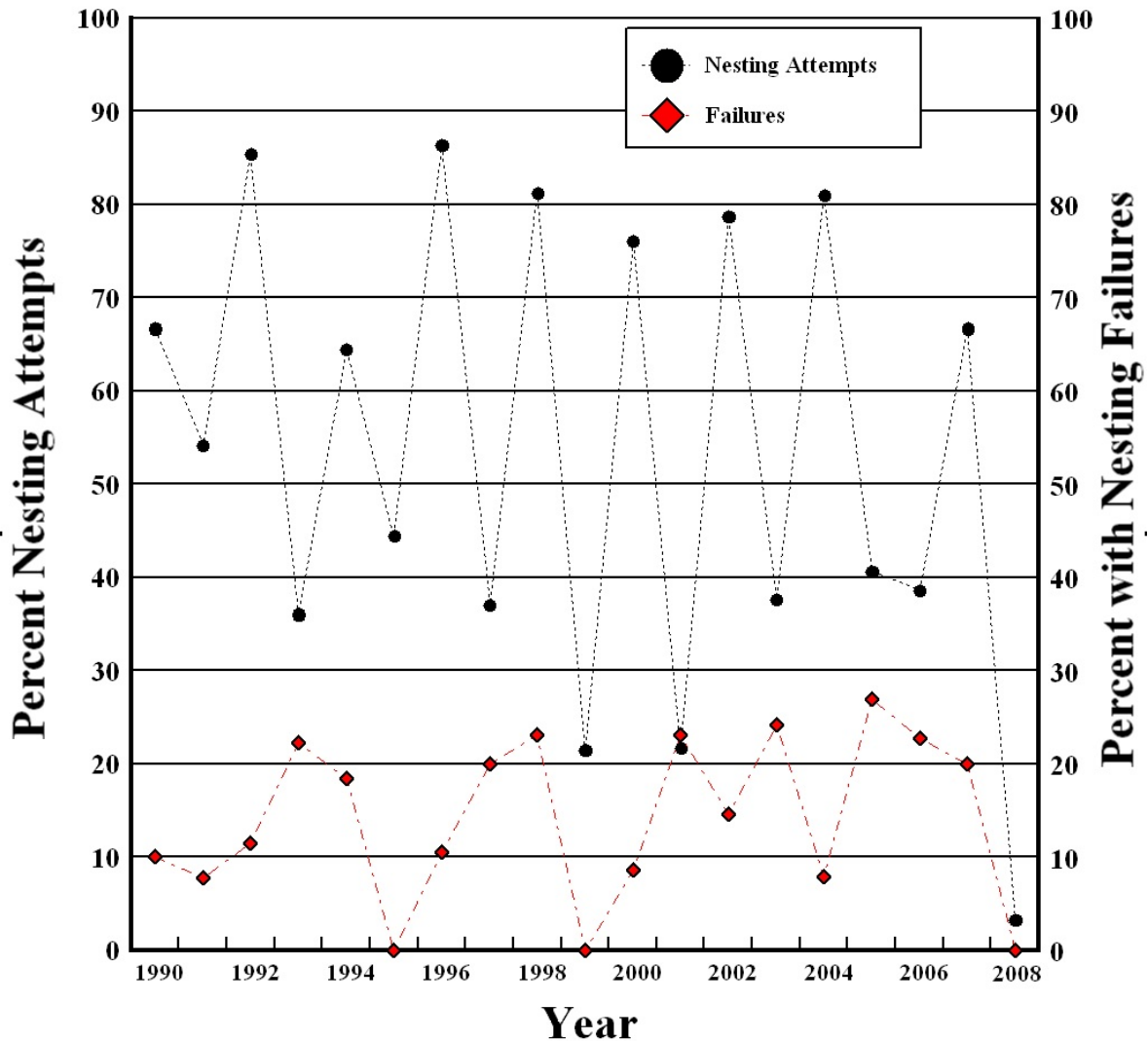


Figure 6. Percentages of northern spotted owl pairs attempting to nest and nesting failures on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008.

There were no documented nest failures in 2008. Annually, the rate of nest failure has been approximately 14% (SE = 2.02, n = 19; min. = 0.0, max. = 26.9). The rate of nesting failures appears to be unrelated to the number of pairs attempting to nest ( $X^2 = 18.3$ , 18 df,  $p = 0.434$ ) (Figure 6)(Zar 1996).

### Reproductive Success

A single pair produced a one young in 2008 ( $\bar{x} = 26.4$ , SE = 3.87, n = 19; min. = 1; max. = 64). The number of pairs which have been located with young has varied annually following a pattern similar to nesting attempts. The average number of young produced per total number of pairs surveyed to protocol was 0.02 which was far fewer than the mean for all years of the study ( $\bar{x} = 0.68$ , SE = 0.10, n = 19)(Figure 7).

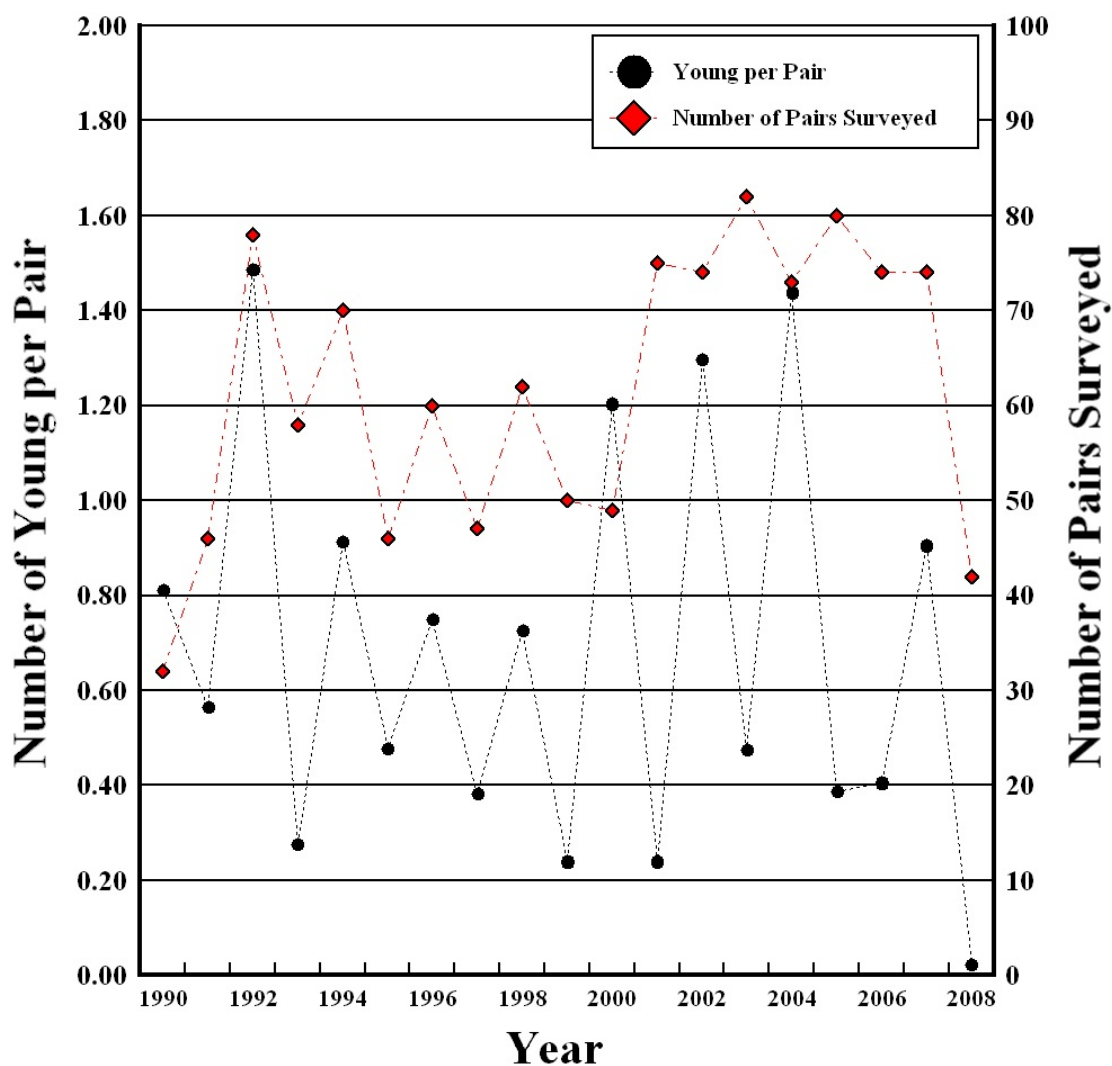


Figure 7. The number of young produced per total number of owl pairs surveyed to protocol on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008.

The number of young produced per successful pair (1.00) was the fewest recorded on the study since its inception ( $\bar{x} = 1.58$ ,  $SE = 0.049$ ,  $n = 19$ ) reflecting the very low productivity recorded in 2008 (Table 4).

Table 4. Summary of reproductive success of northern spotted owls on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008<sup>a</sup>.

| Year | # Pairs Checked | # Pairs Fledging Young | # Young Fledged | % Pairs Producing Young | Average # of Young/Successful Pair | Average # of Young/Pair |
|------|-----------------|------------------------|-----------------|-------------------------|------------------------------------|-------------------------|
| 1990 | 32              | 18                     | 26              | 56                      | 1.44                               | 0.81                    |
| 1991 | 46              | 17                     | 26              | 37                      | 1.53                               | 0.57                    |
| 1992 | 78              | 64                     | 116             | 82                      | 1.81                               | 1.49                    |
| 1993 | 58              | 11                     | 16              | 19                      | 1.45                               | 0.28                    |
| 1994 | 70              | 35                     | 64              | 50                      | 1.83                               | 0.91                    |
| 1995 | 46              | 14                     | 22              | 30                      | 1.57                               | 0.48                    |
| 1996 | 60              | 30                     | 45              | 50                      | 1.50                               | 0.75                    |
| 1997 | 47              | 12                     | 18              | 26                      | 1.50                               | 0.38                    |
| 1998 | 62              | 33                     | 45              | 53                      | 1.36                               | 0.73                    |
| 1999 | 50              | 7                      | 12              | 14                      | 1.71                               | 0.24                    |
| 2000 | 49              | 34                     | 59              | 69                      | 1.74                               | 1.20                    |
| 2001 | 75              | 11                     | 18              | 15                      | 1.64                               | 0.24                    |
| 2002 | 74              | 51                     | 96              | 69                      | 1.88                               | 1.30                    |
| 2003 | 82              | 23                     | 39              | 28                      | 1.70                               | 0.48                    |
| 2004 | 73              | 58                     | 105             | 79                      | 1.81                               | 1.44                    |
| 2005 | 80              | 23                     | 31              | 29                      | 1.35                               | 0.39                    |
| 2006 | 74              | 19                     | 30              | 26                      | 1.58                               | 0.41                    |
| 2007 | 74              | 41                     | 67              | 55                      | 1.63                               | 0.91                    |
| 2008 | 42              | 1                      | 1               | 2                       | 1.00                               | 0.02                    |

<sup>a</sup> All sites which were surveyed to reproductive protocol (Forsman 1995).

An average of 0.04 and 0.00 young fledged per pair in LSR and Matrix areas in 2008, respectively. Between 1997 and 2008, the average number of young produced per pair in LSRs ( $\bar{x} = 0.66$ ,  $SE = 0.148$ ,  $n = 12$ ; min. = 0.04, max. = 1.40) and Matrix areas ( $\bar{x} = 0.65$ ,  $SE = 0.113$ ,  $n = 12$ ; min. = 0.00, max. = 1.46) has been similar (Table 5). No young were fledged in Wilderness areas in 2008 ( $\bar{x} = 0.53$ ,  $SE = 0.195$ ,  $n = 11$ ; min. = 0.0, max. = 1.67). This was the lowest number of young fledged for each of the Land-use Allocations during the study.

Reproductive success for all of the LSRs was either the lowest or equalled the lowest number ever recorded during the study. Owl pairs in the Rogue-Umpqua Divide LSR produced no young in 2008 ( $\bar{x} = 0.71$ ,  $SE = 0.170$ ; min. = 0.00, max. = 1.83). No young were fledged in the Middle Fork LSR ( $\bar{x} = 0.67$ ,  $SE = 0.163$ ,  $n = 12$ ; min. = 0.0, max. = 1.67). The average reproductive success of owl pairs in the Dead Indian LSR (0.16) was less than in most years ( $\bar{x} = 0.61$ ,

Table 5. Summary of reproductive success for northern spotted owls, by Land-use Allocation, on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1997-2008<sup>a</sup>.

| LUA    | Year | Number of Pairs Checked | Number of Pairs Fledging Young | Number of Young Fledged | Percentage of Pairs Producing Young | Average Number of Young/Successful Pair | Average Number of Young/Pair | Mean Fecundity <sup>b</sup> , # Females |
|--------|------|-------------------------|--------------------------------|-------------------------|-------------------------------------|---|------------------------------|---|
| Matrix |      |                         |                                |                         |                                     |   |                              |   |
|        | 1997 | 17                      | 6                              | 9                       | 35                                  | 1.50                                    | 0.53                         | 0.219 (16)                              |
|        | 1998 | 17                      | 10                             | 13                      | 59                                  | 1.30                                    | 0.77                         | 0.367 (15)                              |
|        | 1999 | 15                      | 6                              | 10                      | 40                                  | 1.67                                    | 0.67                         | 0.400 (15)                              |
|        | 2000 | 14                      | 7                              | 11                      | 50                                  | 1.57                                    | 0.79                         | 0.393 (14)                              |
|        | 2001 | 21                      | 4                              | 6                       | 19                                  | 1.50                                    | 0.29                         | 0.150 (20)                              |
|        | 2002 | 23                      | 12                             | 24                      | 52                                  | 2.00                                    | 1.04                         | 0.545 (22)                              |
|        | 2003 | 23                      | 6                              | 11                      | 26                                  | 1.83                                    | 0.48                         | 0.229 (24)                              |
|        | 2004 | 22                      | 18                             | 32                      | 82                                  | 1.78                                    | 1.46                         | 0.727 (22)                              |
|        | 2005 | 28                      | 8                              | 10                      | 29                                  | 1.25                                    | 0.36                         | 0.167 (30)                              |
|        | 2006 | 22                      | 6                              | 10                      | 27                                  | 1.67                                    | 0.46                         | 0.217 (23)                              |
|        | 2007 | 20                      | 11                             | 19                      | 55                                  | 1.72                                    | 0.95                         | 0.475 (21)                              |
|        | 2008 | 14                      | 0                              | 0                       | 0                                   | 0.00                                    | 0.00                         | 0.000 (16)                              |
| LSR    |      |                         |                                |                         |                                     |   |                              |   |
|        | 1997 | 28                      | 6                              | 9                       | 21                                  | 1.50                                    | 0.32                         | 0.161 (28)                              |
|        | 1998 | 38                      | 21                             | 30                      | 55                                  | 1.43                                    | 0.79                         | 0.395 (38)                              |
|        | 1999 | 32                      | 1                              | 2                       | 3                                   | 2.00                                    | 0.06                         | 0.032 (32)                              |
|        | 2000 | 30                      | 24                             | 42                      | 80                                  | 1.75                                    | 1.40                         | 0.677 (31)                              |
|        | 2001 | 47                      | 7                              | 12                      | 15                                  | 1.71                                    | 0.26                         | 0.125 (48)                              |
|        | 2002 | 46                      | 34                             | 62                      | 74                                  | 1.82                                    | 1.35                         | 0.674 (46)                              |
|        | 2003 | 49                      | 16                             | 27                      | 33                                  | 1.69                                    | 0.55                         | 0.276 (49)                              |
|        | 2004 | 43                      | 32                             | 60                      | 74                                  | 1.88                                    | 1.40                         | 0.674 (43)                              |
|        | 2005 | 46                      | 13                             | 19                      | 28                                  | 1.46                                    | 0.41                         | 0.202 (47)                              |
|        | 2006 | 45                      | 12                             | 18                      | 27                                  | 1.50                                    | 0.40                         | 0.191 (47)                              |
|        | 2007 | 47                      | 29                             | 46                      | 62                                  | 1.59                                    | 0.98                         | 0.469 (49)                              |
|        | 2008 | 24                      | 1                              | 1                       | 4                                   | 1.00                                    | 0.04                         | 0.038 (26)                              |
| CRWA   |      |                         |                                |                         |                                     |   |                              |   |
|        | 1997 | 2                       | 0                              | 0                       | 0                                   | NA                                      | 0                            | 0.000 (2)                               |
|        | 1998 | 7                       | 2                              | 2                       | 29                                  | 1.00                                    | 0.29                         | 0.143 (7)                               |
|        | 1999 | 3                       | 0                              | 0                       | 0                                   | NA                                      | 0                            | 0.000 (3)                               |
|        | 2000 | 5                       | 3                              | 6                       | 60                                  | 2.00                                    | 1.20                         | 0.600 (5)                               |
|        | 2001 | 7                       | 0                              | 0                       | 0                                   | NA                                      | 0                            | 0.000 (7)                               |
|        | 2002 | 6                       | 5                              | 10                      | 83                                  | 2.00                                    | 1.67                         | 0.833 (6)                               |
| cont.  |      |                         |                                |                         |                                     |   |                              |   |

| LUA  | Year | Number of Pairs Checked | Number of Pairs Fledging Young | Number of Young Fledged | Percentage of Pairs Producing Young | Average Number of Young/Successful Pair | Average Number of Young/Pair | Mean Fecundity <sup>b</sup> , # Females |
|------|------|-------------------------|--------------------------------|-------------------------|-------------------------------------|---|------------------------------|---|
| CRWA |      |                         |                                |                         |                                     |   |                              |   |
|      | 2003 | 10                      | 1                              | 1                       | 10                                  | 1.00                                    | 0.10                         | 0.045 (11)                              |
|      | 2004 | 8                       | 8                              | 13                      | 100                                 | 1.63                                    | 1.63                         | 0.813 (8)                               |
|      | 2005 | 6                       | 2                              | 2                       | 33                                  | 1.00                                    | 0.33                         | 0.143 (7)                               |
|      | 2006 | 7                       | 1                              | 2                       | 14                                  | 1.00                                    | 0.29                         | 0.143 (7)                               |
|      | 2007 | 7                       | 1                              | 2                       | 14                                  | 1.00                                    | 0.29                         | 0.143 (7)                               |
|      | 2008 | 5                       | 0                              | 0                       | 0                                   | 0.00                                    | 0.00                         | 0.000 (6)                               |

<sup>a</sup> All sites which were surveyed to reproductive protocol (Forsman 1995).

<sup>b</sup> Average fecundity estimate = number of female young produced per female owl (assume a 1:1 sex ratio of young at birth).

SE = 0.125, n = 12; min. = 0.0, max. = 1.39). The smaller LSRs have relatively greater fluctuations in the annual number of young fledged per pair, reflecting small sample sizes. No young were found at Clover Creek LSR ( $\bar{x}$  = 0.41, SE = 0.200, n = 11; min. = 0.0, max. = 2.00) or the Sevenmile Creek LSR ( $\bar{x}$  = 0.74, SE = 0.230, n = 12; min. = 0.0, max. = 2.00) in 2008.

The average fecundity recorded in 2008 (age classes combined) for the LSR was (0.04) per female ( $\bar{x}$  = 0.33, SE = 0.072, n = 12, min. = 0.02, max. = 0.67). In both the Matrix LUA and the Wilderness no young were produced ( $\bar{x}$  = 0.32, SE = 0.057, n = 12, min. = 0.00, max. = 0.67 and  $\bar{x}$  = 0.23, SE = 0.092, n = 12, min. = 0.00, max. = 0.73; respectively) (Table 5). Commensurate with pair productivity, fecundity in 2008 either equaled the previous minimum or was the lowest recorded during the study for all Land-use categories.

Average fecundity was 0.01 (SE = 0.010, n = 48) for females (Figure 8) in 2008 ( $\bar{x}$  = 0.33, SE = 0.048, n = 18; min. = 0.01, max. = 0.74). Average fecundity was 0.01 (SE = 0.011, n = 44) for adults, and 0 for subadults.

## Bandings/Re-observation

We banded 7 owls (1 fledgling, 2 subadults and 4 adults) on the study area in 2008, and there were a total of 90 non-juveniles owls of known identity in the sample. The minimum average age for males was 8.5 years (SE = 0.58, n = 46) and 7.2 years (SE = 0.52, n = 44) for females. The minimum age of the oldest owl in the sample was at least 18 years of age. The greatest minimum age of owls in the sample during the study appears to have reached an asymptote in the range of 16 to 18 years (Figure 9).

There were 16 major inter-territory movements of banded owls in 2008. One owl originally banded as a juvenile in 2007 emigrated out of the study area. Two owls originally banded as juveniles (in 2004 and 2006), one as a subadult, and 6 as adults were recaptured at new locations



within the study area. Two owls originally banded as adults immigrated onto the study area while and one emigrated off the study.

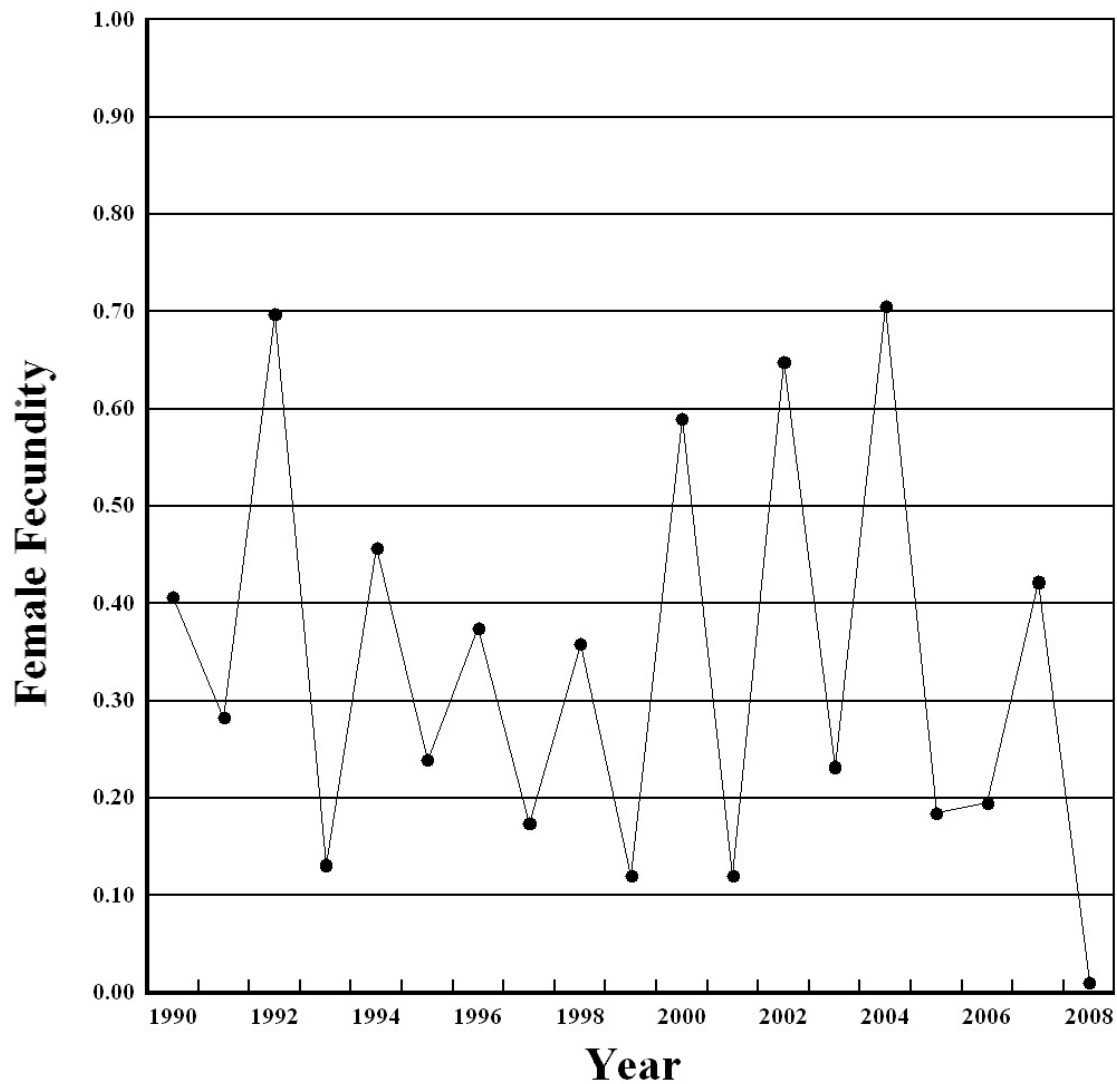


Figure 8. Mean annual fecundity for female owls on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008. Fecundity calculated as the mean number of young fledged per female checked for reproductive success divided by 2 and assuming a 1:1 sex ratio of young at birth.

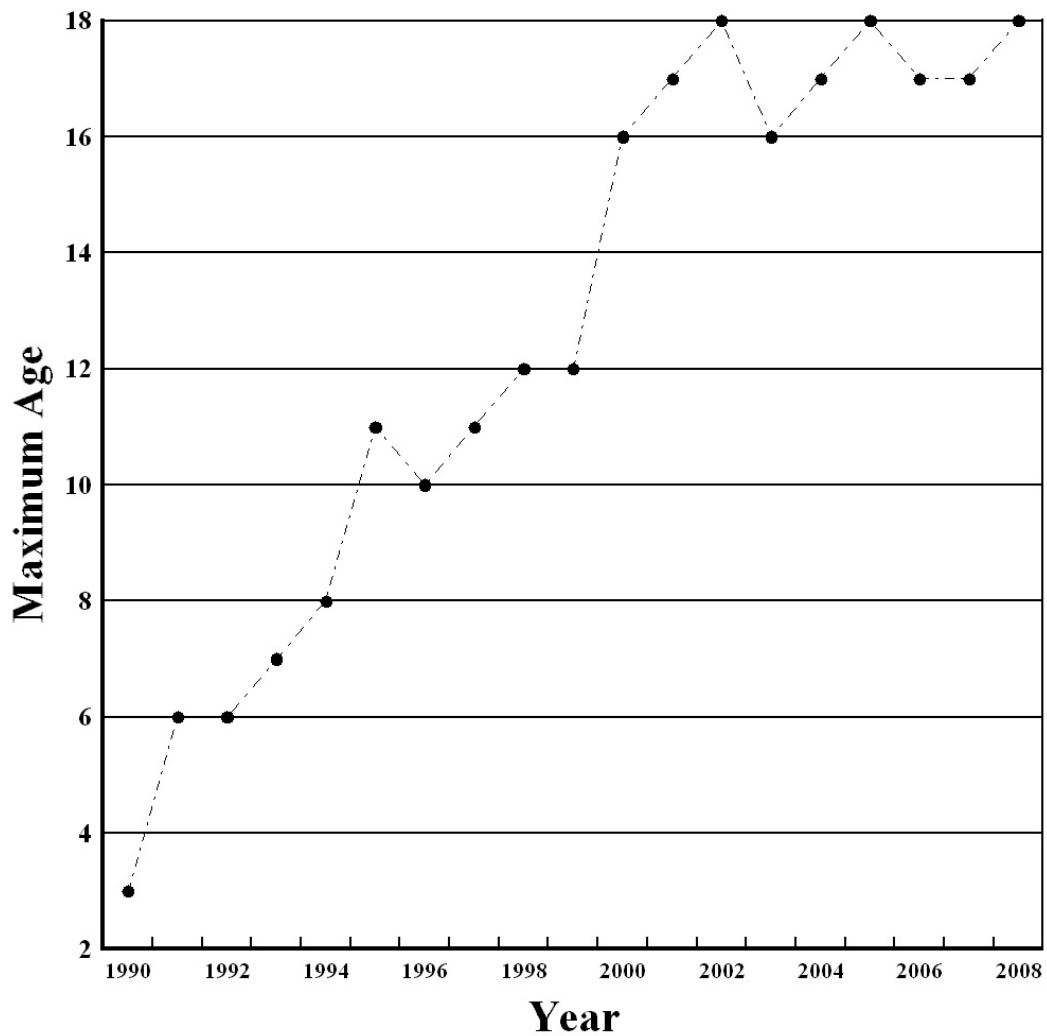


Figure 9. Estimated age of the oldest known spotted owl on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, 1990-2008.

Over the course of the study, a total of 114 owls banded as juveniles have dispersed and been re-observed. The average dispersal distance for all juveniles was 33.3 km (SE = 2.23; min. = 3.5, max. = 82.5, n = 59) for females and 23.0 km (SE = 2.42; min. = 3.2, max. = 93.2, n = 55) for males (Figure 10).

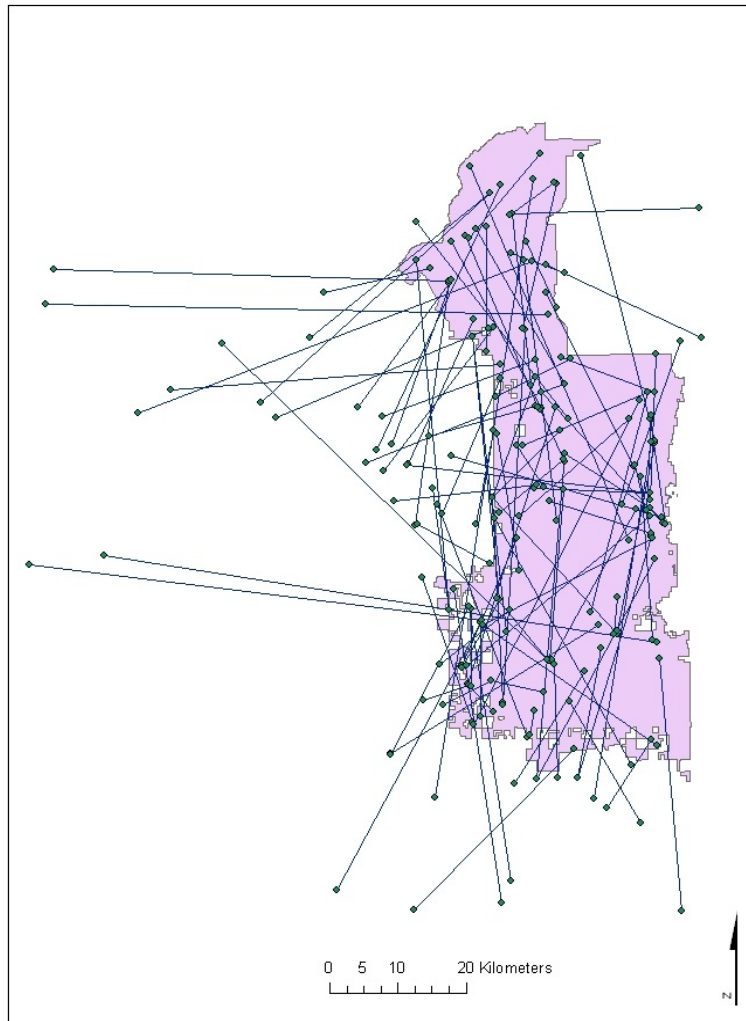


Figure 10. Juvenile spotted owl dispersal on and adjacent to the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, 1990-2008.

A total of 104 movements by non-juvenile owls have been recorded since 1990 (Figure 11). The mean movement distance was 10.1 km for females (SE = 1.91,  $n = 46$ ; min. = 0.9, max. = 77.3) and 6.6 km (SE = 0.79,  $n = 58$ ; min. = 0.8, max. = 28.2) for males. These movements for banded territorial owls were much less than for juveniles and many such movements were within the study area.

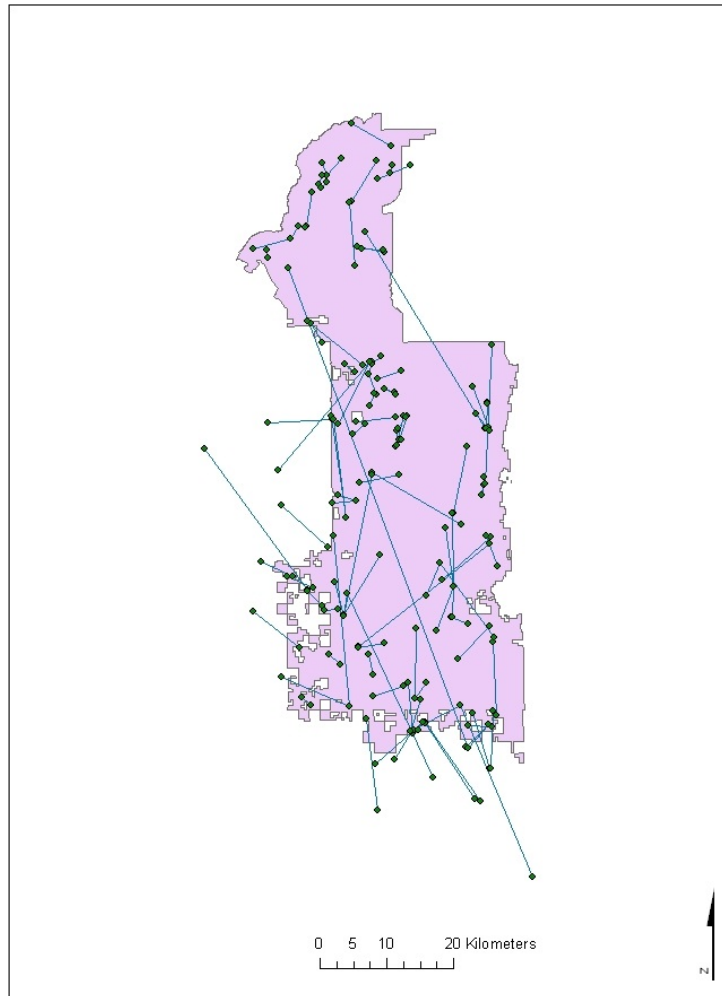


Figure 11. Non-juvenile spotted owl movements on and adjacent to the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, 1990-2008.

### Spotted Owl Diets

We initiated an analysis of northern spotted owl diets in 2000, and a total of 4,352 prey specimens in regurgitated pellets were collected and identified at 121 owl sites between 2000-2006. The sample consists primarily of northern flying squirrels (*Glaucomys sabrinus*) and woodrat species (*Neotoma cinerea* and *N. fuscipes*). Lagomorphs and pocket gophers (*Thomomys mazama* and *T. talpoides*) also comprised an important proportion of the prey biomass (Figure 12).

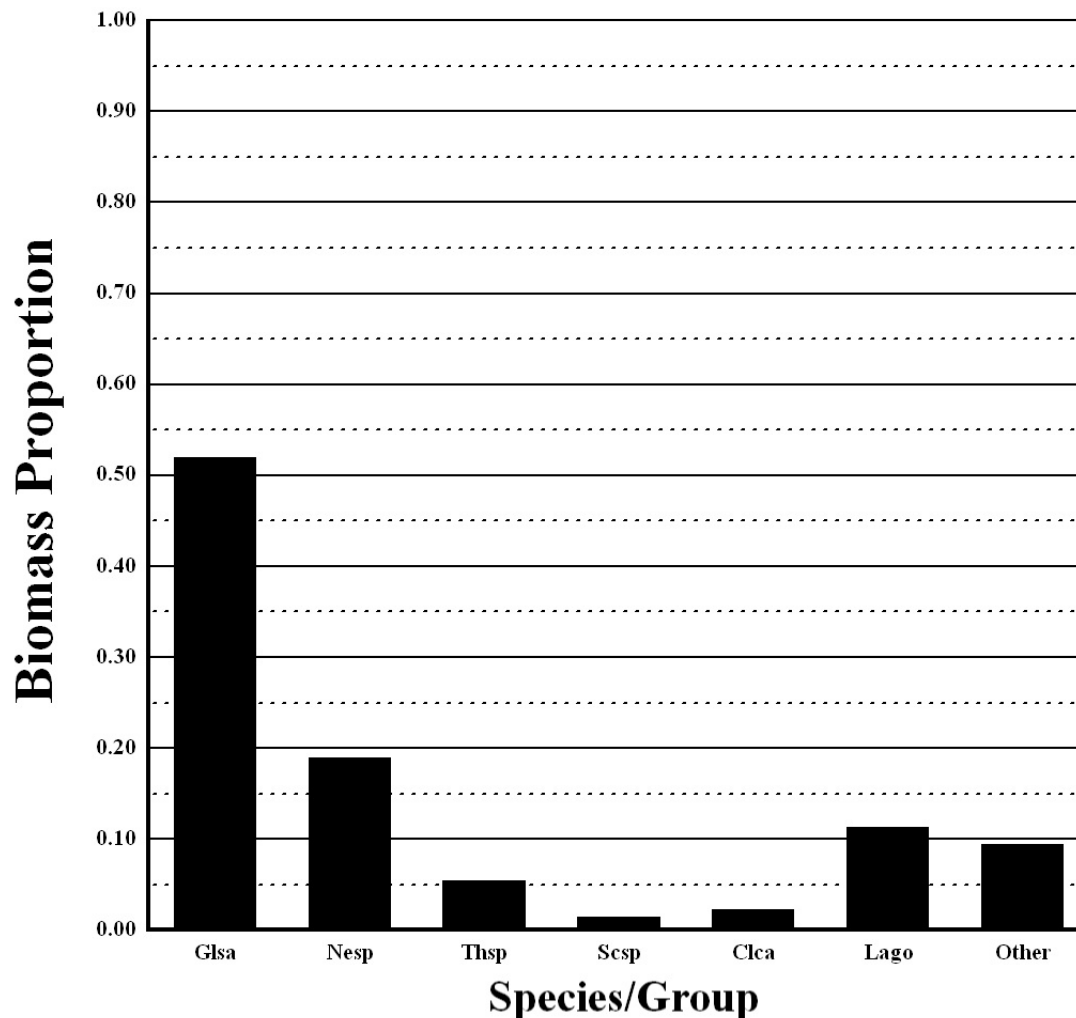


Figure 12. Biomass of prey items collected from spotted owl pellets on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 2000-2006. Clca = *Clethrionomys californicus*, Glsa = *Glaucomys sabrinus*, Nesp = *Neotoma* species, Lago = Lagomorphs, Scsp = *Scapanus* species, Thsp. = *Thomomys* species.

## Barred Owls

The range of northern barred owls (*Strix varia*) has expanded during the last century and now overlaps that of northern spotted owls. Barred owls were first detected within the boundaries of the Southern Cascades Study Area in 1981. This study was not designed to systematically follow trends in barred owl occupancy but has gathered a significant number of anecdotal detections during the course of spotted owl surveys. The annual percentage of historic territories with both spotted owls and barred owls or barred owls alone has increased from 8.6 to 21.9% since 1997 (Figure 13).

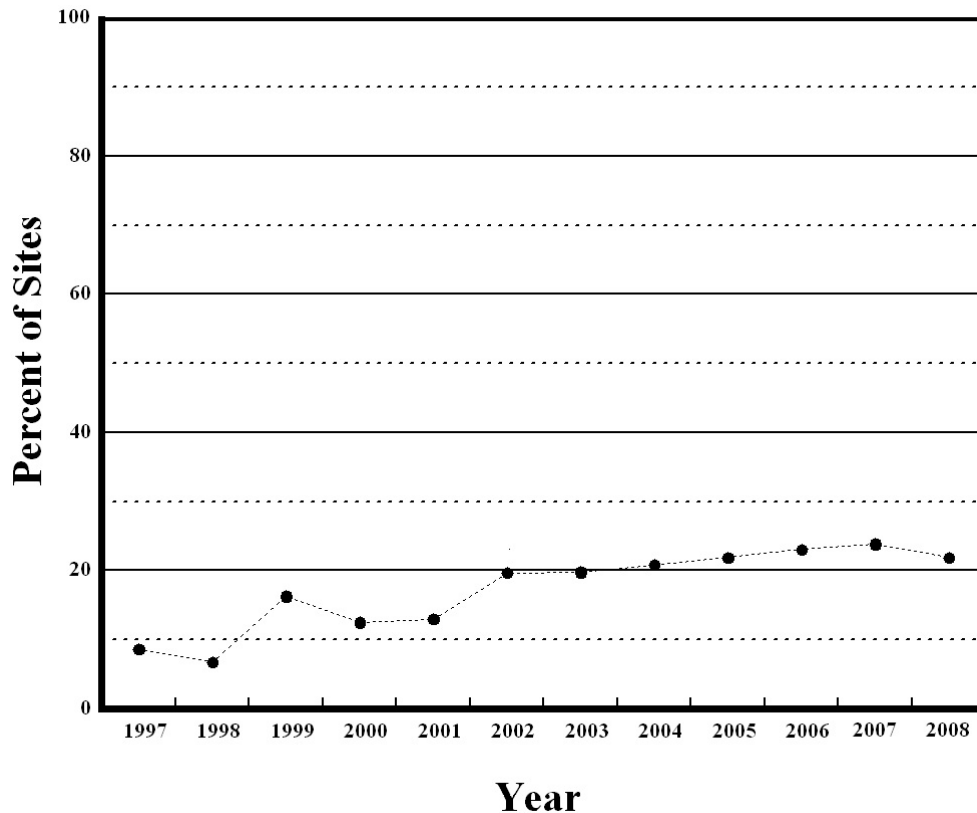


Figure 13. The annual percentage of historic spotted owl territories where barred owls have been detected on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1997-2008.

Barred owl detections were not evenly distributed geographically across the study area. Cumulatively, 54% of the sites have had at least one year and up to as many as 13 years with a barred owl detection (Figure 14). Detecting barred owls is problematic given the study design because some barred owls may be missed or may represent transient individuals detected during spotted owl surveys. Additional research using improved methodology is needed to evaluate and predict the effects of barred owl range expansion on spotted owls (Kelly et al. 2003, Anthony et al. 2006).

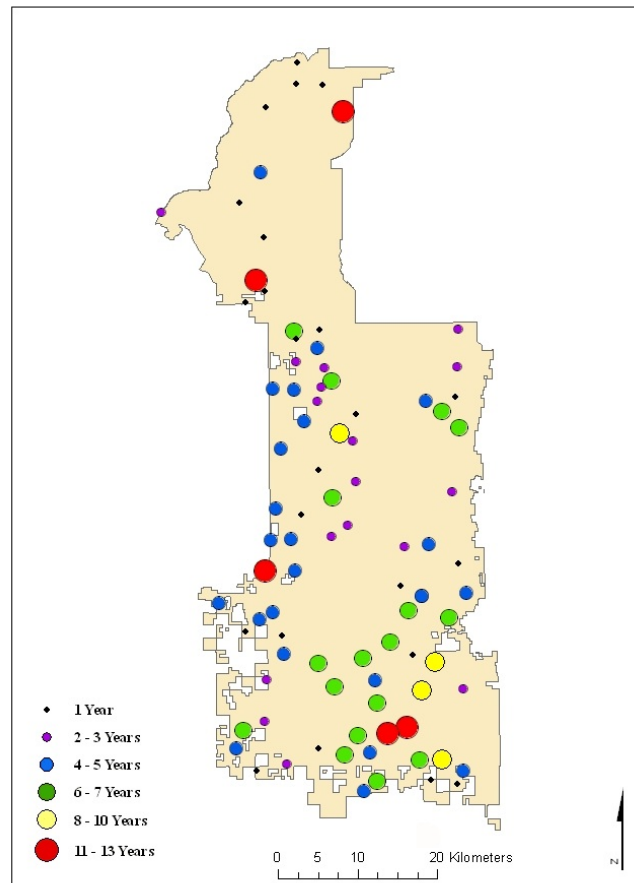


Figure 14. Proportional representation of the number of years that barred owls were detected at historic spotted owl territories on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2008.

### **Middle Fork Fire**

In August 2008 fires from multiple lightning strikes, collectively referred to as the Lonesome Complex, culminated in a large wildfire originating in the Middle Fork of the Rogue River. The Middle Fork fire affected approximately 8,540 ha in a mixed severity wildfire mosaic. The Middle Fork fire affected 7 historic owl territories within the boundaries of the Southern Oregon Cascades Study Area, and 4 of the sites were occupied by spotted owls in 2008 (Figure 15). Several of these sites have had better than average occupancy and productivity during the course of the study. We plan to monitor these sites closely in the coming years in order to document any changes in spotted owl occupancy that may be associated with the fire.

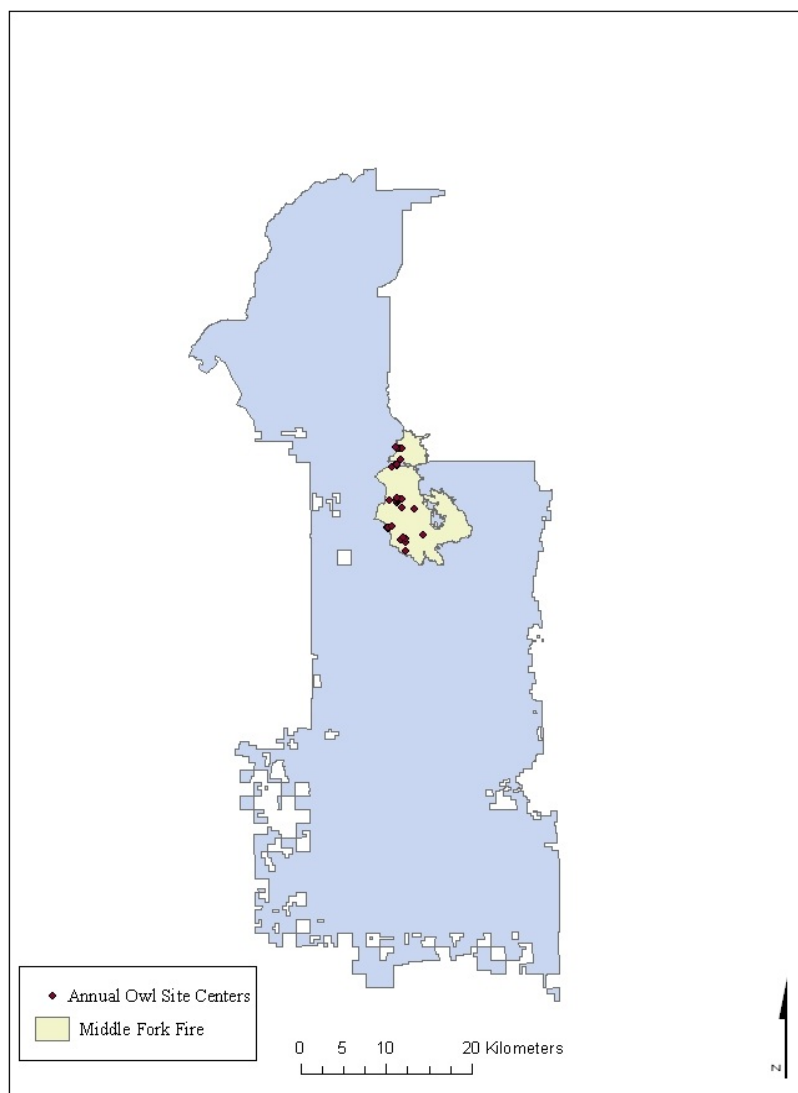


Figure 15. Middle Fork Fire boundary and associated spotted owl territories in the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 2008.

### **Apparent Survival, Fecundity, and Population Trend**

A workshop was conducted to analyze range-wide demographic data of northern spotted owls in January 2009. Fecundity, apparent survival, and population trend were estimated for the Southern Oregon Cascades Study Area during the workshop. A report on the results of the analysis is expected to be finalized in the spring of 2009 and will be included in our annual report for 2009.



## **Discussion**

Precipitation and snowpack in the south Cascades was approximately 40% greater than the average at the beginning of the 2008 field season. This reduced our early access to most of the sites on the study area and our efficiency. Inclement weather through much of the month of May continued to hamper our survey efforts during the nesting season. Spotted owl detections are highest during the nesting season, and consequently, we may have missed early nesting attempts and previously banded owls.

Occupancy, nesting, productivity and the total number of known identity owls in 2008 was the lowest ever recorded for the Southern Oregon Cascades Study Area. There was also an increase in the number of sites that were occupied by spotted owls but the social status was not determined, and some of these sites may have been in fact occupied by pairs. It is unlikely, however, that the measures all of these parameters would be uniformly reduced to this degree by reduced survey effort due to limited access.

In 2008 a single spotted owl nesting attempt was documented and a single spotted juvenile was fledged. Through the course of the study productivity has followed a strong biannual pattern of alternating high and low years, which was disrupted by low productivity in both 2005 and 2006. This event is similar to other study areas within the range of the spotted owl.

Dugger et al. (2006) found that in this study area precipitation in the early nesting season tended to reduce productivity west of the Cascades, and this may well have been born out in 2008. Precipitation was also found to have a positive effect on survival throughout the study area, however, this was counter-intuitive for the 2008 seasons results. The uncharacteristically wet early breeding season may have biased our survival estimates low as an artifact of reduced survey access.

At five sites we completed our final survey to determine non-occupancy in the first week of September. This meets the requirements of the Effectiveness Monitoring Programs for the northern spotted owl in the Northwest Forest Plan but was too late to meet the more stringent protocol by Forsman (1995).

While we report that 169 owl sites were surveyed in 2008, in total, surveys were conducted at 181 historic spotted owl locations on the study area. Over the course of the study approximately 12 historic sites have been aggregated with nearby owl sites. Three sites were newly aggregated for the 2008 report as additional years of data indicate that historic detections probably represented owls moving between multiple activity centers within a single home-range.

## **9. Acknowledgments:**

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River-Siskiyou and Fremont-Winema National Forest Supervisors Offices', the Regional Office of the U.S. Forest Service, and the Klamath Falls, Roseburg, and the Portland Offices' of the U.S. Fish and Wildlife Service for their support.

**10. Research Plans for FY 2009:**

- a. Continue the demographic study, including stratification of owl sites by Land-use Allocation.
- b. Continue the collection of pellets and analysis of spotted owl diets.
- c. Continue the collection of data on northern spotted owl nest trees/nest sites.
- d. Continue to assist personnel from Crater Lake National Park with their banding program.

**11. Technology Transfer Completed in FY 2008:**

- a. R.G. Anthony (workshop coordinator) and S. Andrews participated in a workshop to conduct a range-wide meta-analysis of northern spotted owl demography held in January 2009, Corvallis, OR.
- b. R.G. Anthony and S. Andrews participated in data coordination efforts with personnel from other demographic studies.
- c. Project personnel provided the USDA-USFS Ranger Districts, USDI-BLM Resource Areas, and USDI-Crater Lake National Park with information in preparation of the Meta-analysis workshop and have coordinated surveys.

**12. Duration of the Study:**

- a. Initiated in 1990.
- b. This project is part of the long-term Northern Spotted Owl Effectiveness Monitoring Program for the Northwest Forest Plan (Lint et al. 1999).

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